WATER QUALITY SAMPLING AND LAKE BATHYMETRY -- SUMMER 1991

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INTRODUCTION

The 1972 Clean Water Act (33 USC 1251 et seq.) was established to restore and maintain the chemical, physical, and biological diversity of United States waters. The Act also states that the waters constituting outstanding national resources, such as those in the National Parks, should be maintained and protected in their present high quality state. Basic information on physical and chemical properties for lakes within Gates of the Arctic National Park and Preserve is needed in order to maintain and protect current water quality levels. To obtain this information, nine lakes within the park and preserve were studied during summer 1991.

This study was funded through the Resource Management Division of Gates of the Arctic National Park and Preserve. Patty Rost and Kate Swift assisted with fieldwork, as well as pilots Ed Forner and Buster Points. The Fisheries Division of the U.S. Fish and Wildlife, Fairbanks, Alaska graciously loaned the fathometer for conducting bathymetric work. Betsy Sturm (Goldrush Graphics, Fairbanks, Alaska) produced the bathymetric maps from data collected during the study.

STUDY AREA

Gates of the Arctic National Park and Preserve is located above the Arctic Circle in the central Brooks Range, Alaska (Fig. 1). The 33,182 km^2 park and preserve unit spans 2 climate zones: the subarctic zone at low altitudes south of the Brooks Range and the arctic zone to the north. Precipitation is low within the park and preserve, ranging from 30 - 46 cm in the west to 13 - 25 cm in the north. Snow falls average 152 - 203 cm in the south and 89 - 127 cm in the north. Temperatures in the south fluctuate from an average July maximum of 19^{0}C to an average January minimum of -31^{0}C. Temperatures in the north fluctuate from an average July maximum of 16^{0}C to an average February minimum of -22^{0}C (National Park Service 1986).

Boreal forest, tundra, and shrub thickets are the major vegetation communities in the park/preserve. The dense boreal forest south of the mountains, composed of black spruce (*Picea mariana*), white spruce (*P. glauca*), birch (*Betula papyrifera*), aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera*), extends into the southern flanks and valleys of the Brooks Range. Boreal forest is replaced at treeline by shrub birch (*B. nana* and *B. glandulosa*), willow (*Salix* spp.), and alder (*Alnus crispa* and *A. incana*) thickets. Dense willow/alder thickets occur along stream channels and gravel bars at lower elevations. Alpine tundra is found at higher altitudes and on dry ridges and contains low-growing willow, *Dryas* spp., *Saxifraga* spp., and lichens. Moist tundra, composed primarily of cotton sedge (*Eriophorum* spp.), forms in moderate to poorly drained soils in the foothills, mountainsides, and river valleys.

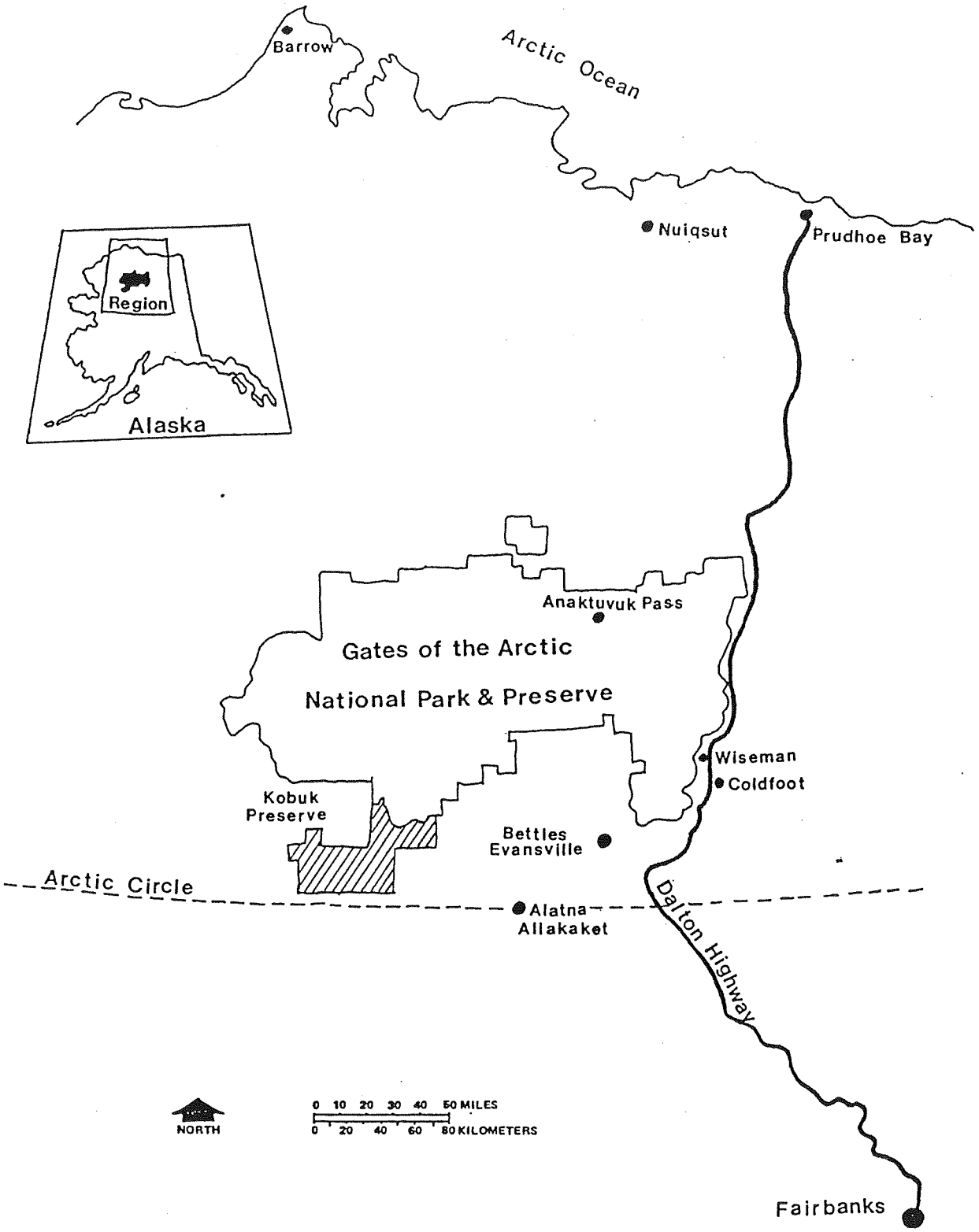


Fig. 1. Location of Gates of the Arctic National Park and Preserve, Brooks Range, Alaska.

METHODS

Water quality parameters were examined in 9 lakes within the park and preserve, 14 - 22 August 1991 (Fig. 2). Conductivity, alkalinity, and water hardness levels were determined from a 1 liter water sample collected at the surface. A Corning Checkmate System conductivity probe and HACH alkalinity and water hardness test kits were used to determine these water quality parameters. Secchi disk readings were obtained to characterize water clarity and light penetration. Temperature and dissolved oxygen (DO) profiles down through the water column were obtained using a YSI DO meter and probe. To facilitate depth measurement, the DO probe and a weight were clipped to a spooled metric cable. DO and temperature data were collected from either the float plane or raft and we attempted to hit the deepest part of the lake (as determined from existing bathymetric maps or from the data collected for bathymetric maps completed during this study).

Bathymetric maps were produced for 4 lakes: Florence Creek Lake, Kipmik Lake, Matcharak Lake, and Takahula Lake (Appendix I). Continuous lake depth measurements were recorded along transect lines using a fathometer. The fathometer sounding device was attached to the side of a motorized raft, and constant speed was maintained while completing a transect. Frequent clearing of aquatic plant buildup on the sounding device was necessary to obtain accurate depth information.

RESULTS

Surface conductivity, alkalinity, and water hardness levels were highest in Takahula Lake and lowest in Kipmik Lake (Table 1), results that also were found during water quality sampling conducted in summer 1990 (NPS 1990). Takahula Lake had the greatest light penetration (Table 1). Light penetration was lowest in Florence Creek Lake (Table 1), probably due to high concentrations of tannin and organic materials in this bog lake.

DO levels were highest in the 10 - 20 m depth range in Nutuvukti, Narvak, and Takahula Lakes (Figs. 3, 4, and 5). Plant and animal life near the lake surface (where light penetration was high) probably was responsible for the lower DO levels within the first 10 m of depth for these lakes. Beyond the 20 m depth, DO levels gradually dropped in Narvak and Takahula Lakes, but remained fairly high in Nutuvukti Lake. Amiloyak and Chandler Lakes maintained somewhat constant temperature and DO levels with depth (Figs. 6 and 7), and the remaining 4 lakes exhibited a general downward trend in both temperature and DO with increasing depth (Figs. 8, 9, 10, and 11).

LITERATURE CITED

National Park Service. 1990. Memorandum to the files regarding 1990 lake water quality sampling. Gates of the Arctic National Park and Preserve, P.O. Box 74680, Fairbanks, Alaska 99707.

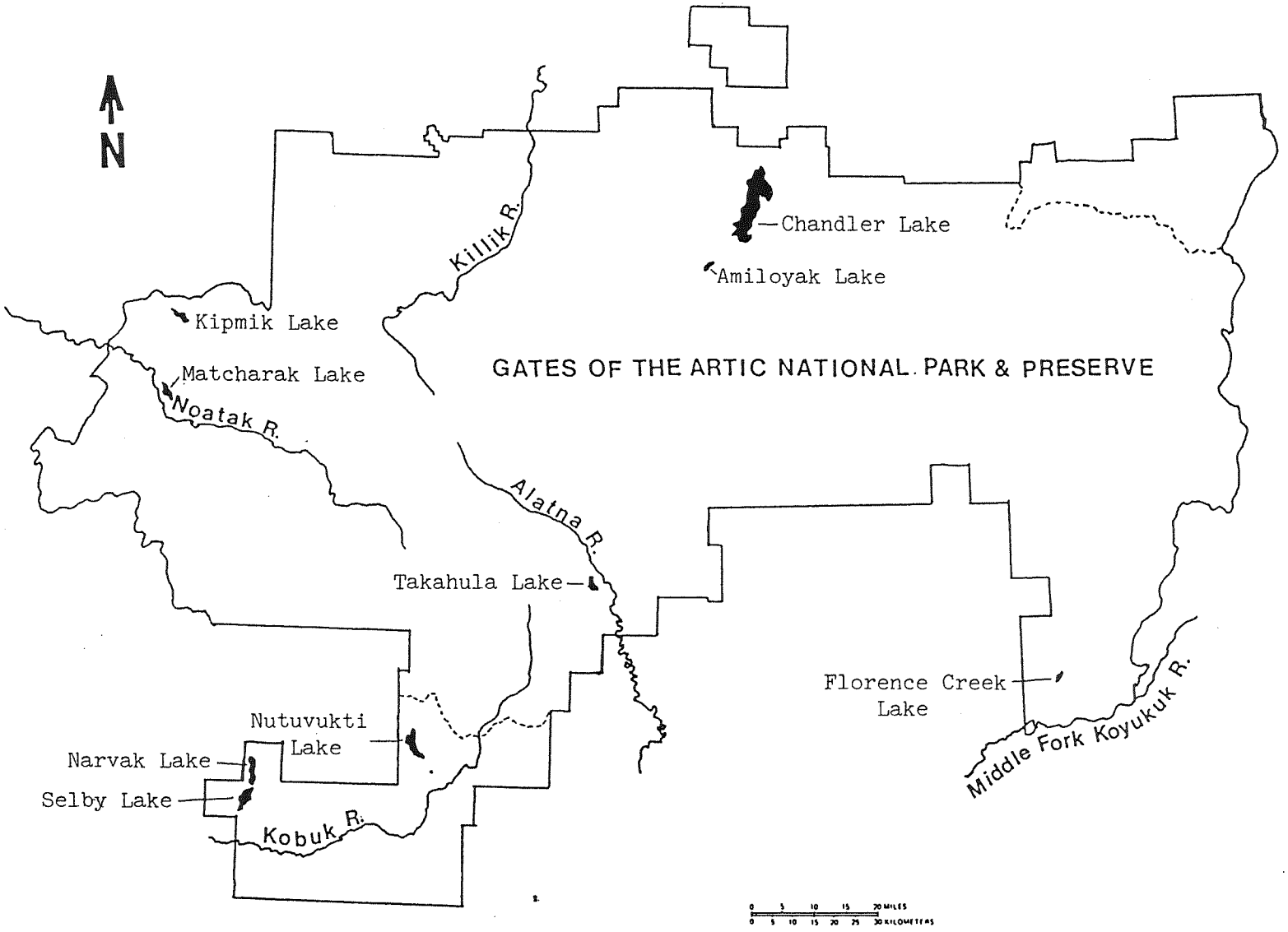


Fig. 2. Location of lakes sampled for water quality in Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 14 - 22 August 1991.

Table 1. Water quality measurements and secchi disk readings for 9 lakes in Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 14-22 August 1991.

Lake (altitude)	Conductivity (uS)	Alkalinity (mg/L $CaCO_3$)	Water Hardness (mg/L $CaCO_3$)	Secchi Depth (m)
Amiloyak Lake (975 m)	51.5	21.2	19.0	5.8
Chandler Lake (914 m)	102.8	23.9	32.0	7
Florence Creek Lake (244 m)	116.0	42.7	61.5	3.9
Kipmik Lake (732 m)	26.2	9.8	15.7	8
Matcharak Lake (488 m)	231.0	114.0	111.0	7
Narvak Lake (182 m)	100.4	25.8	45.4	9
Nutuvukti Lake (244 m)	68.5	24.5	30.0	7.3
Selby Lake (182 m)	93.8	24.1	42.8	6.8
Takahula Lake (31 m)	295.0	123.5	142.5	18

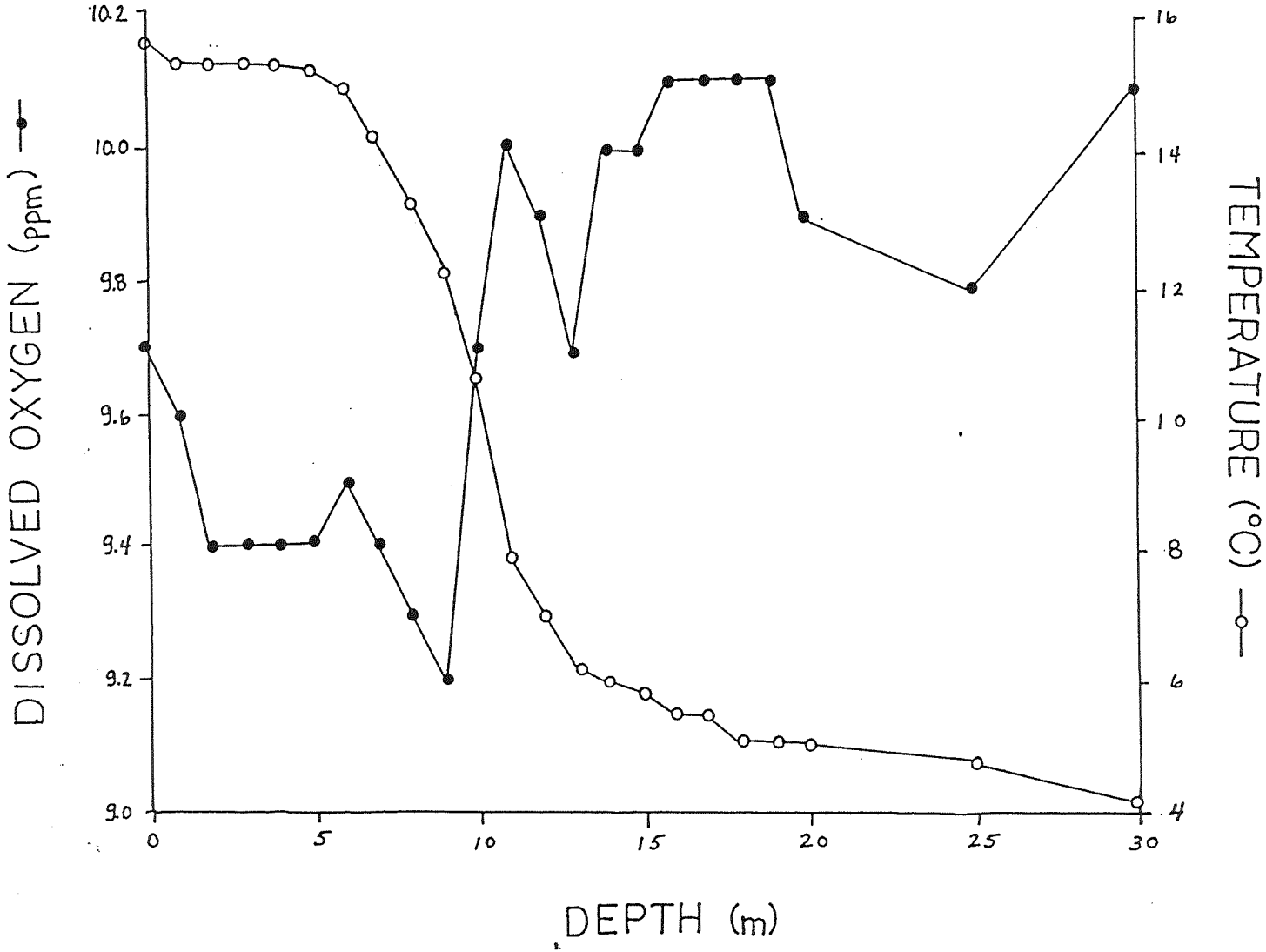


Fig. 3. Dissolved oxygen levels and temperatures through the water column of Nutuvukti Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 21 August 1991.

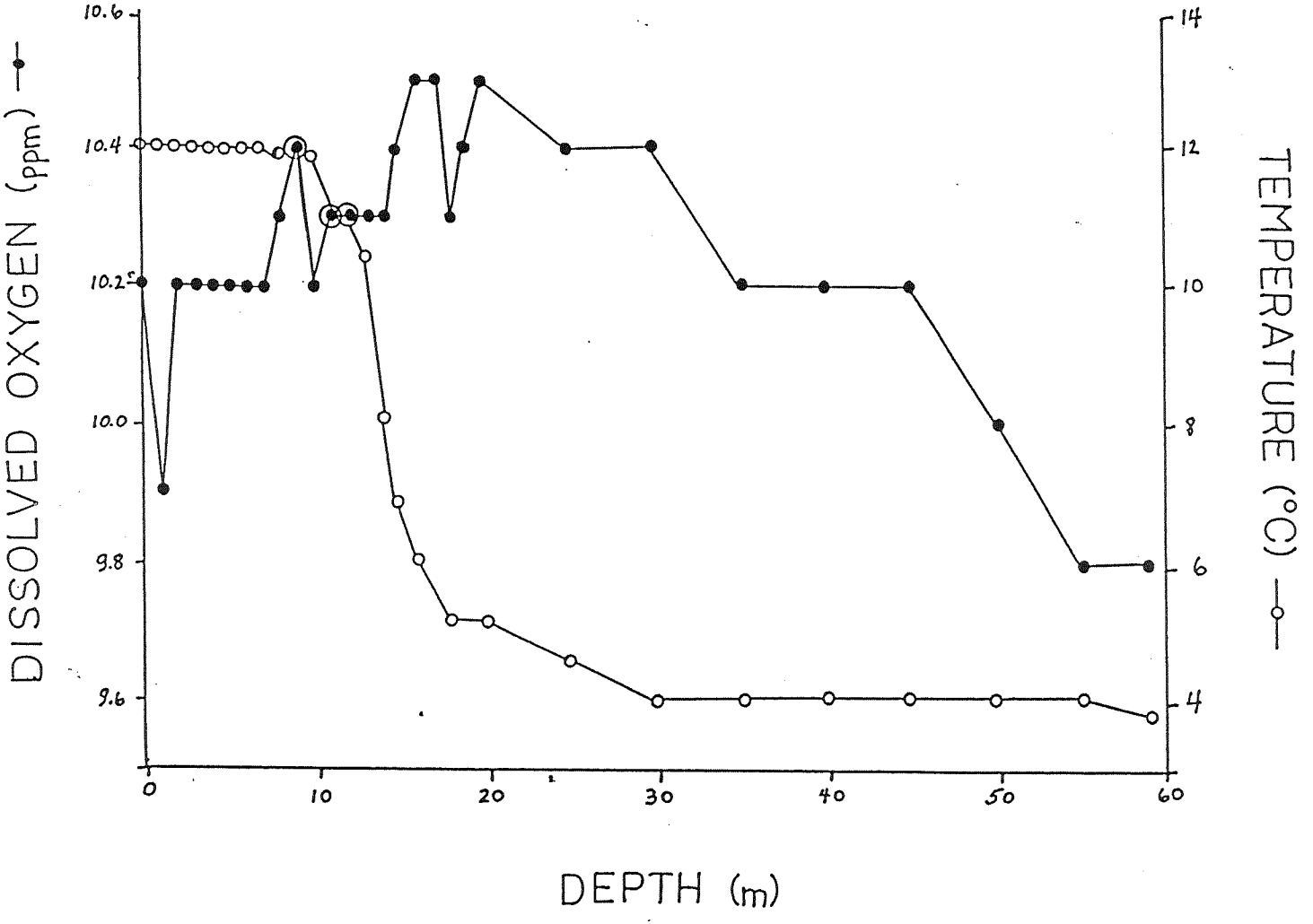


Fig. 4. Dissolved oxygen levels and temperatures throughout the water column of Narvak Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 21 August 1991.

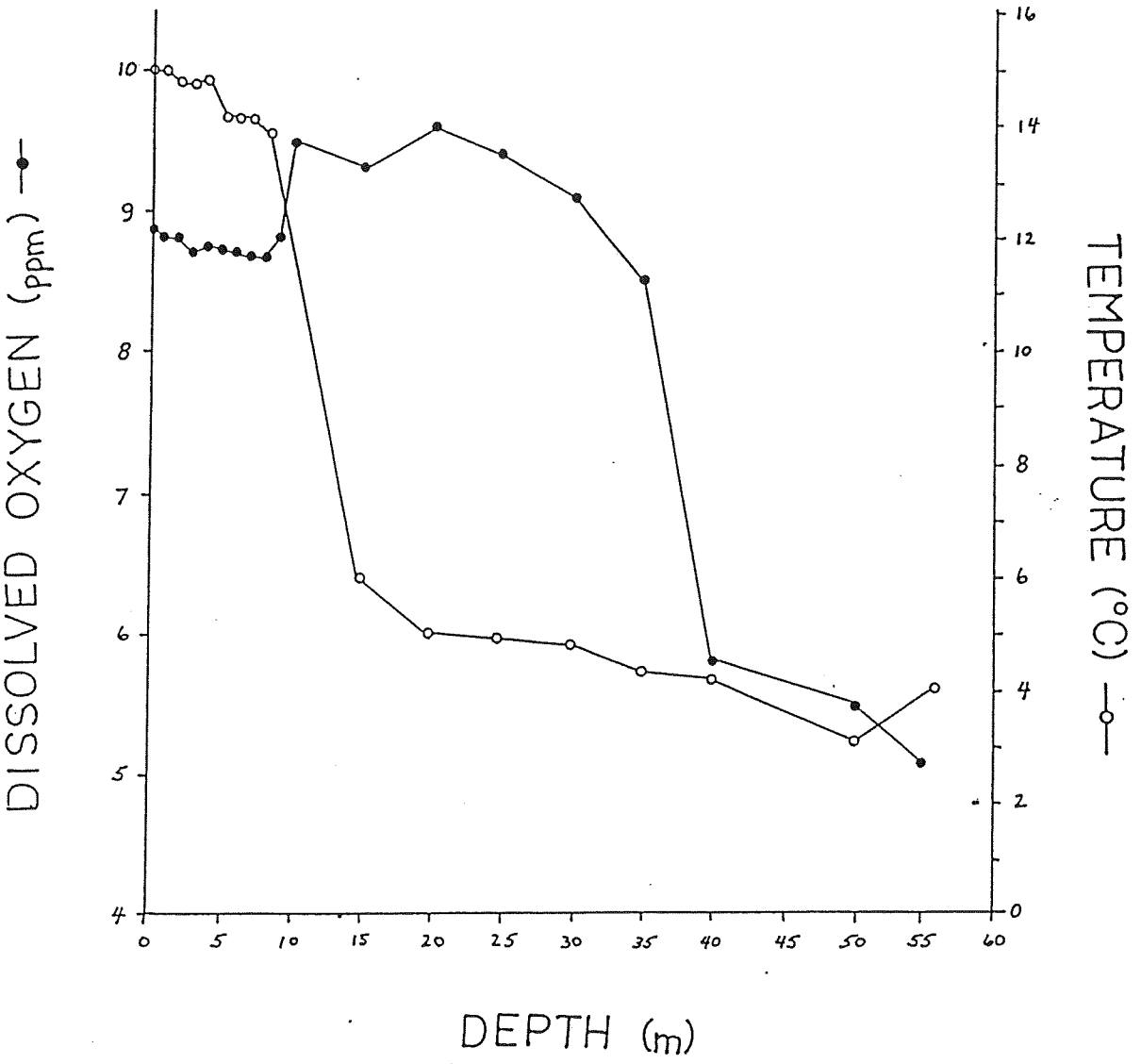


Fig. 5. Dissolved oxygen levels and temperatures throughout the water column of Takahula Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 14 August 1991.

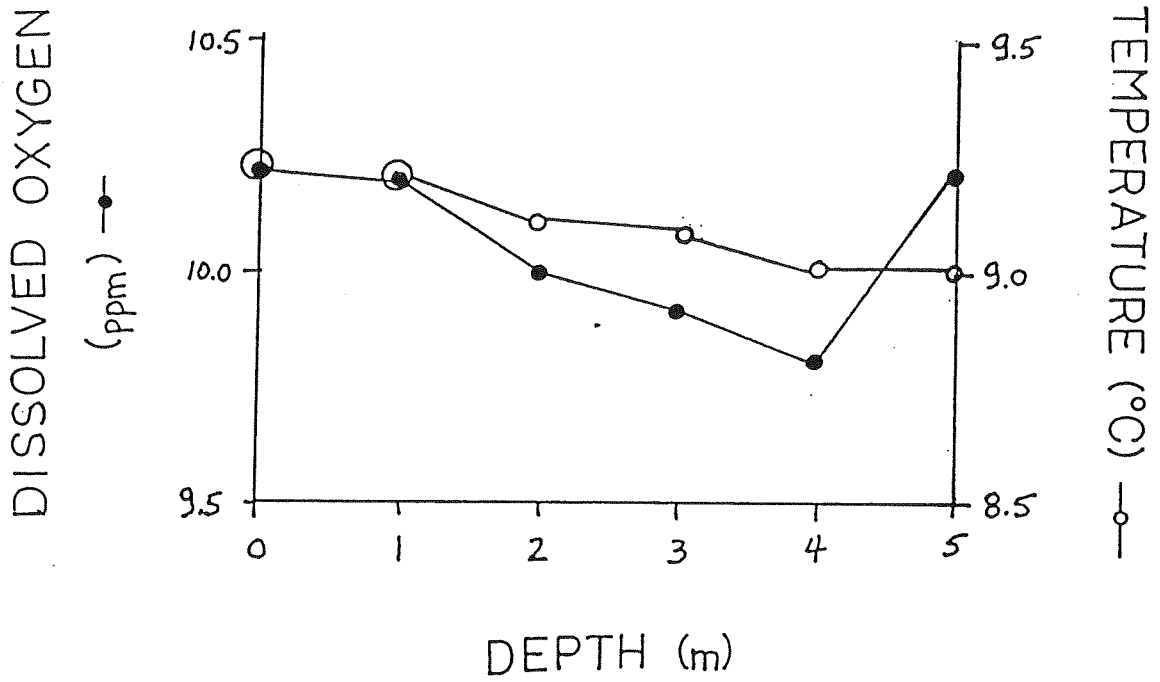


Fig. 6. Dissolved oxygen levels and temperatures throughout the water column of Amiloyak Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 20 August 1991.

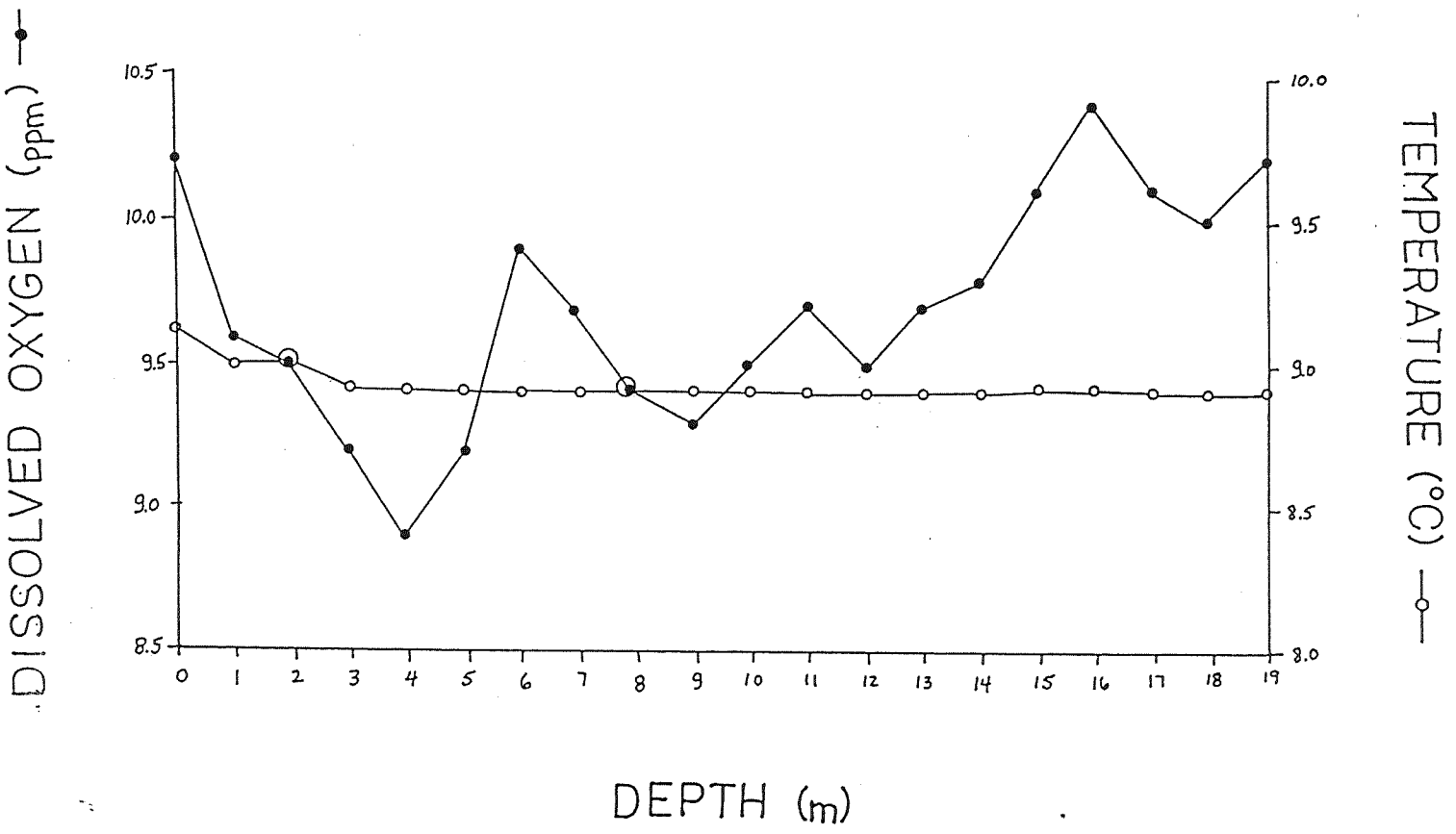


Fig. 7. Dissolved oxygen levels and temperatures throughout the water column of Chandler Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 20 August 1991.

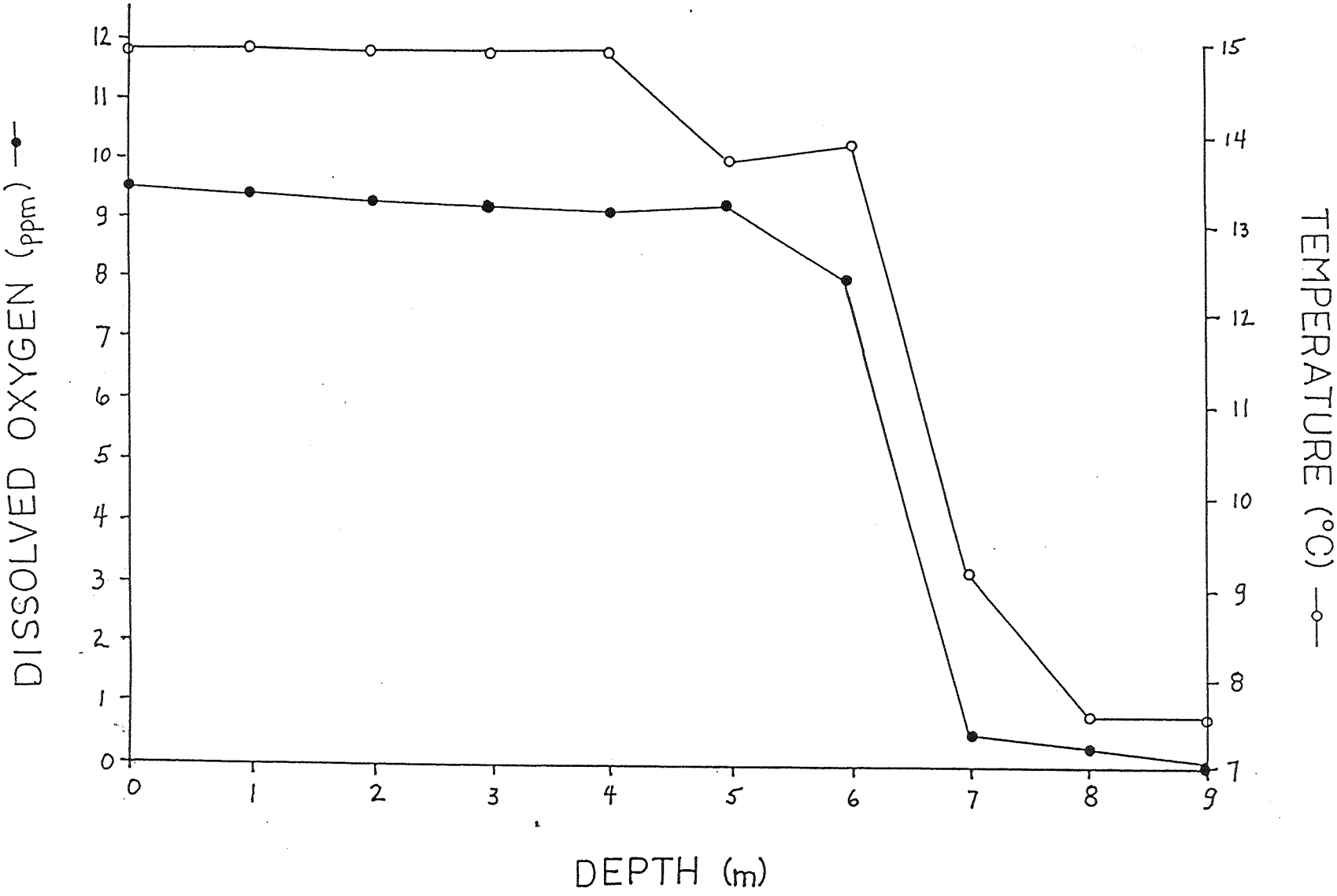


Fig. 8. Dissolved oxygen levels and temperatures throughout the water column of Florence Creek Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 18 August 1991.

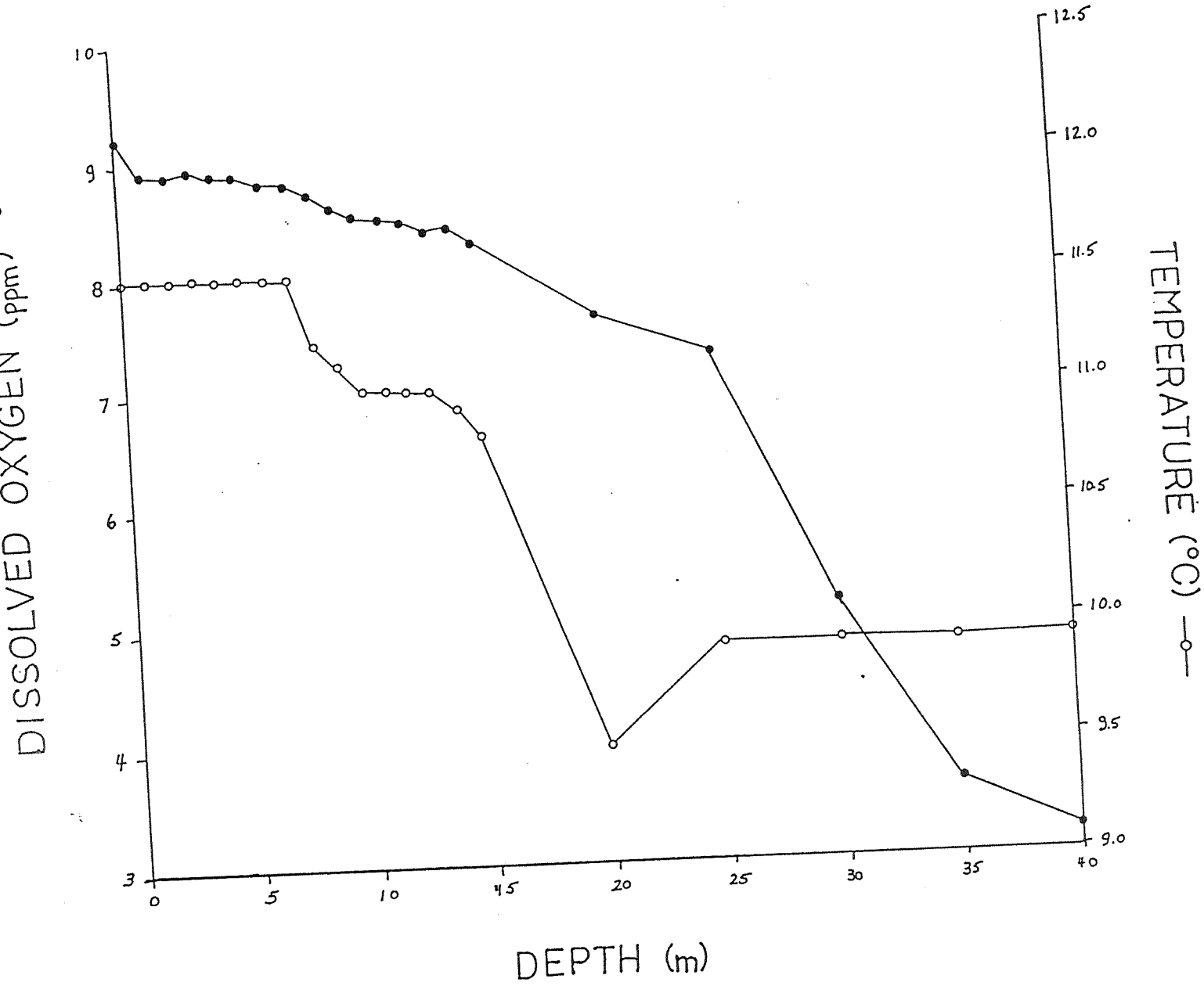


Fig. 9. Dissolved oxygen levels and temperatures throughout the water column of Kipmik Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 16 August 1991.

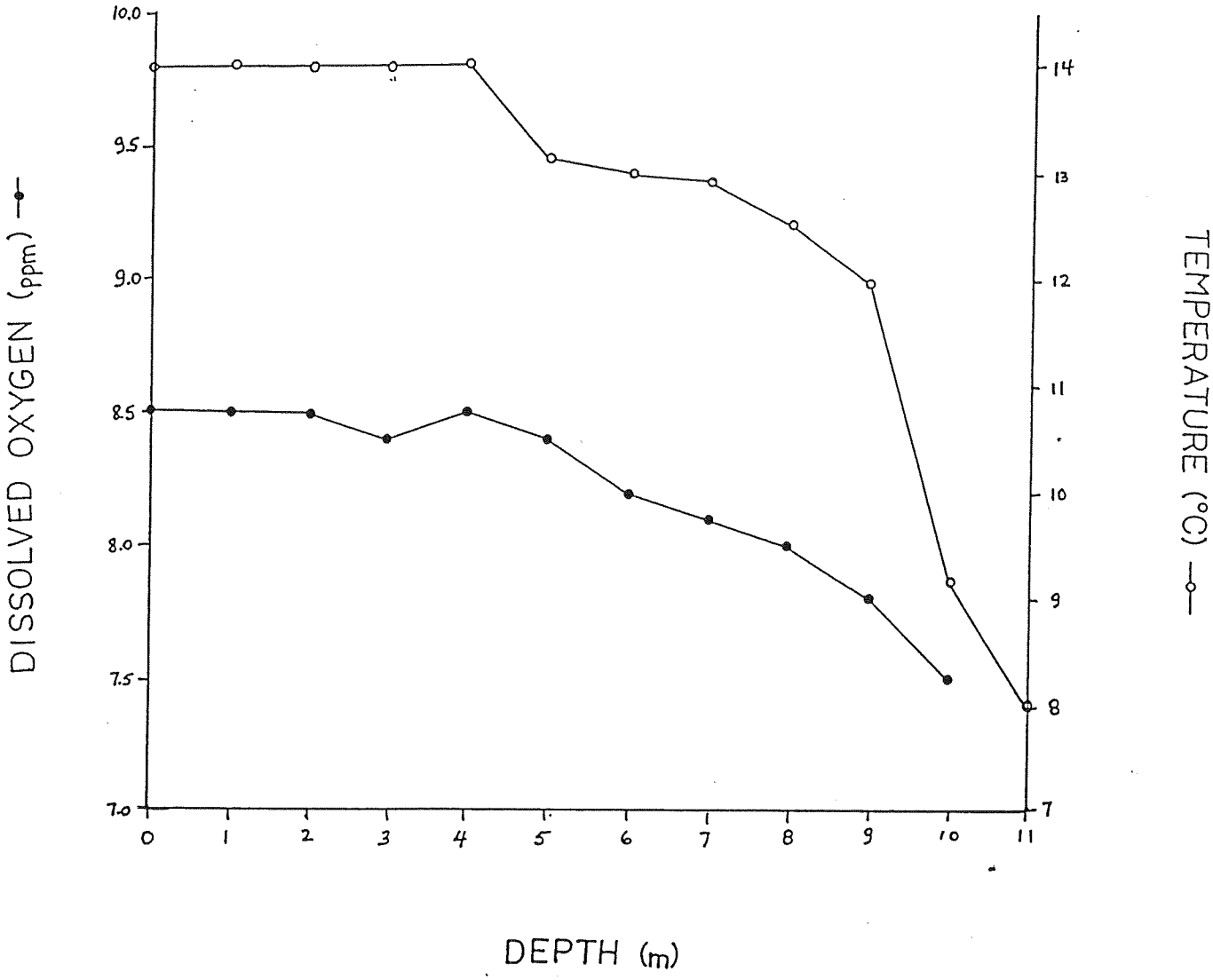


Fig. 10. Dissolved oxygen levels and temperatures throughout the water column of Matcharak Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 15 August 1991.

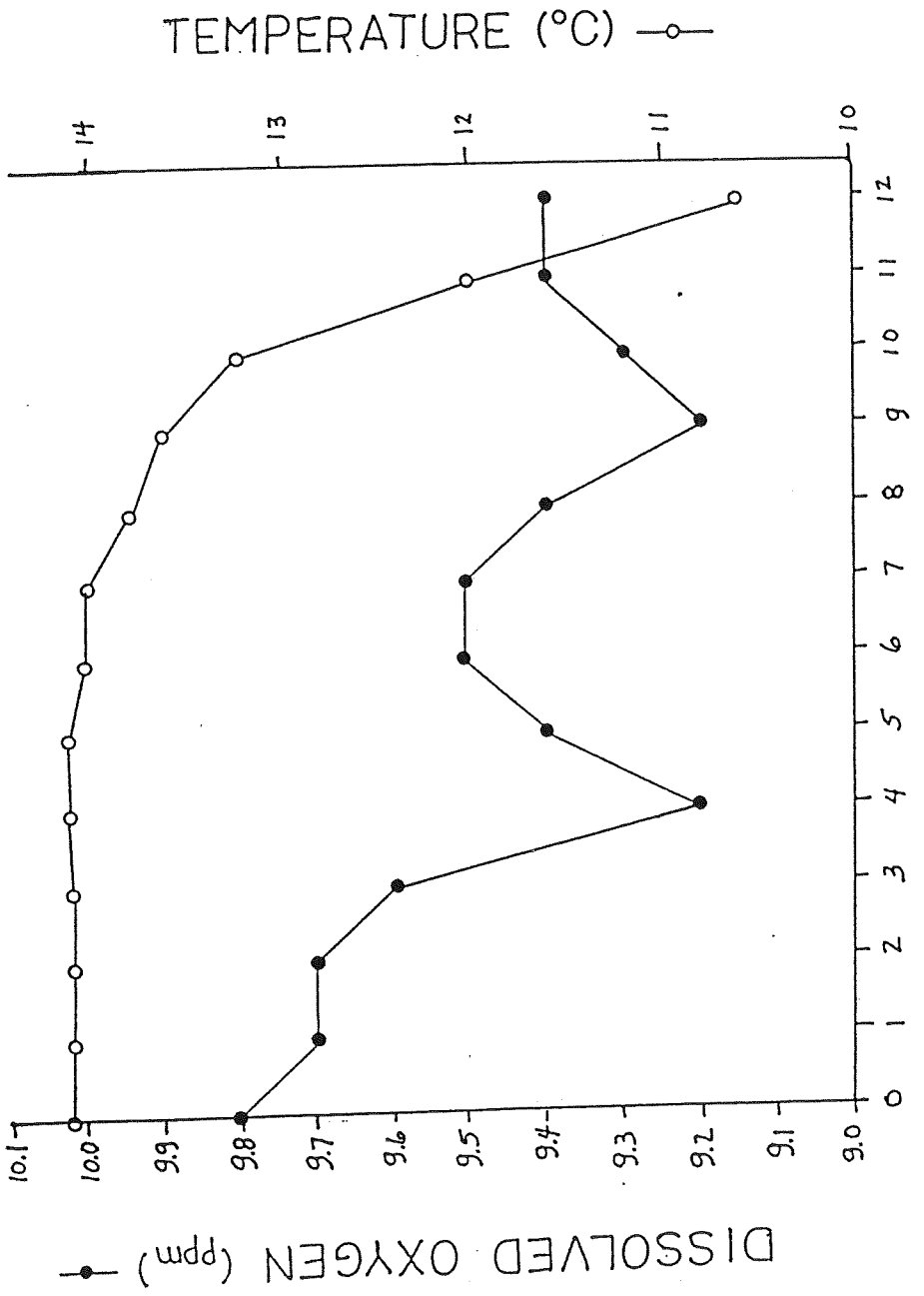
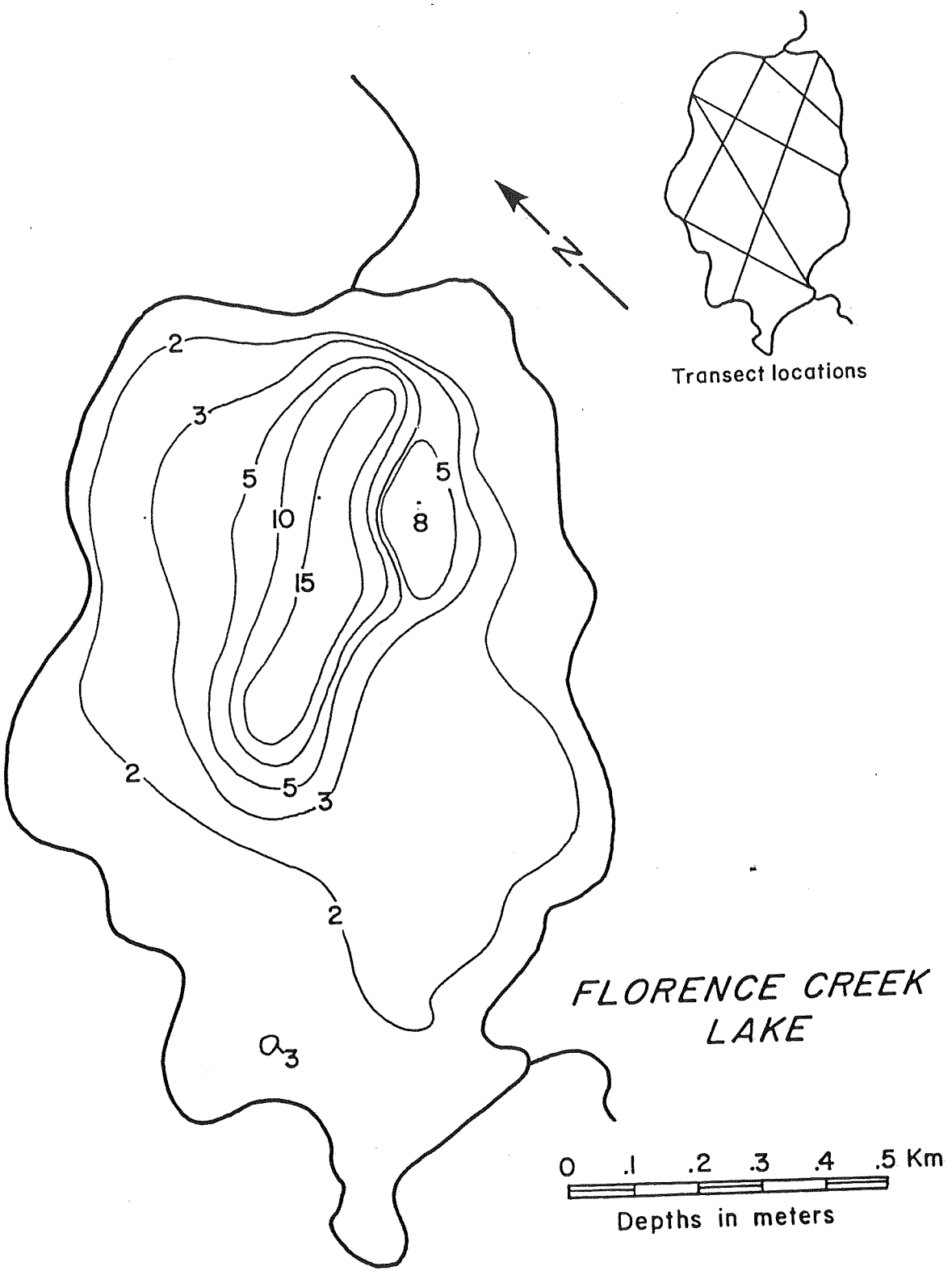


Fig. 11. Dissolved oxygen levels and temperatures throughout the water column of Selby Lake, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 22 August 1991.

Appendix I. Bathymetric maps for Florence Creek, Kipmik, Matcharak, and Takahula Lakes, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska.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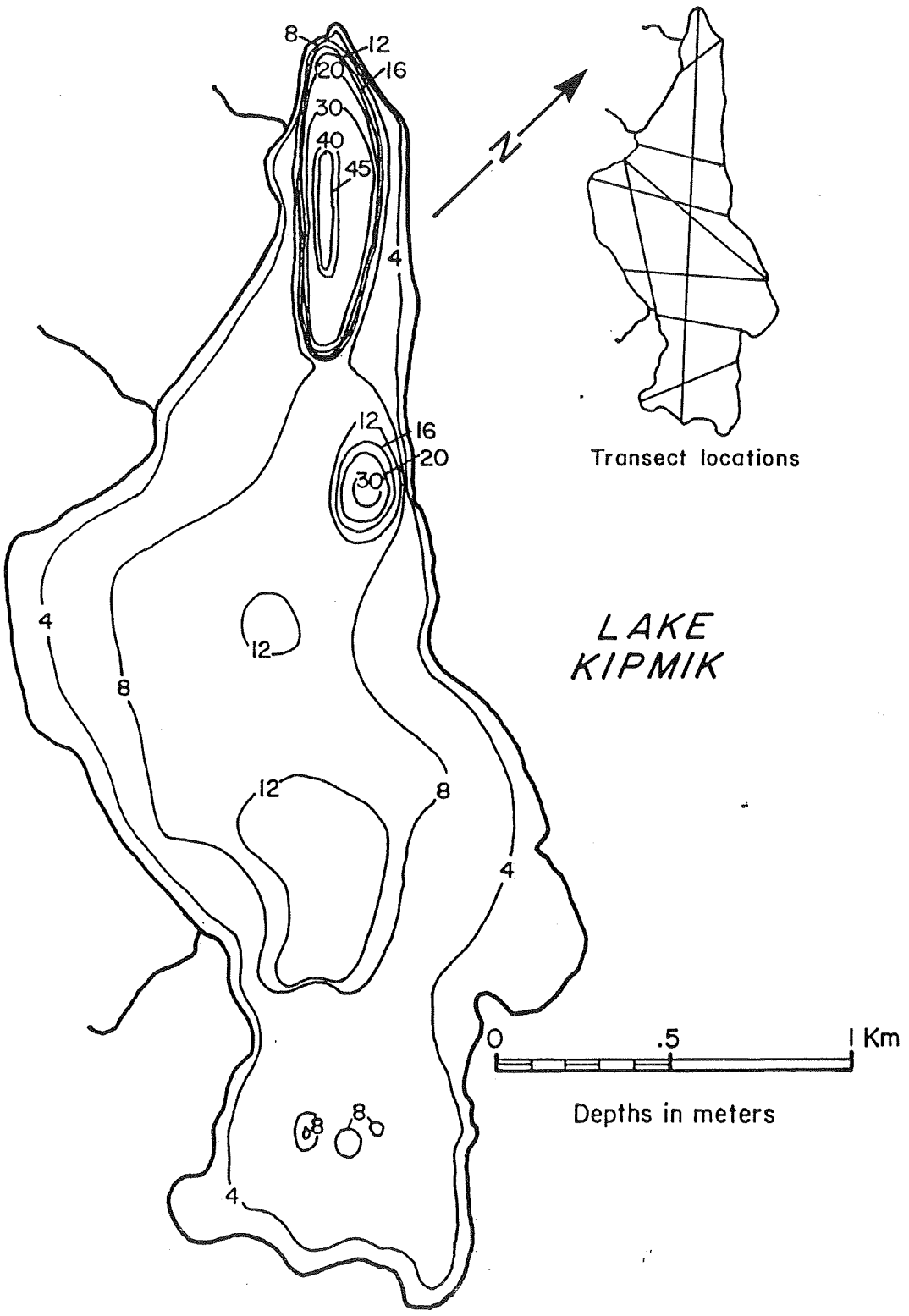
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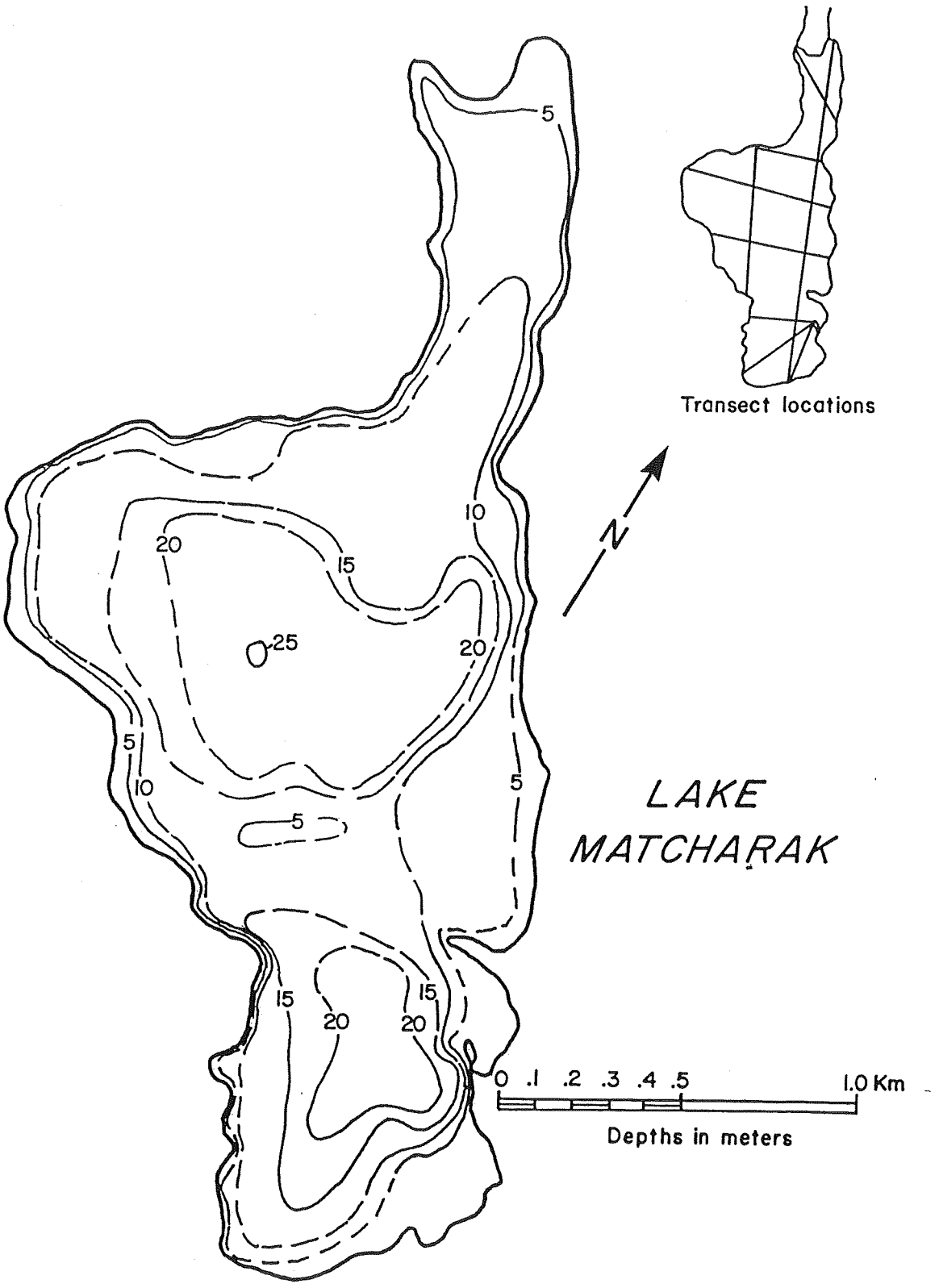
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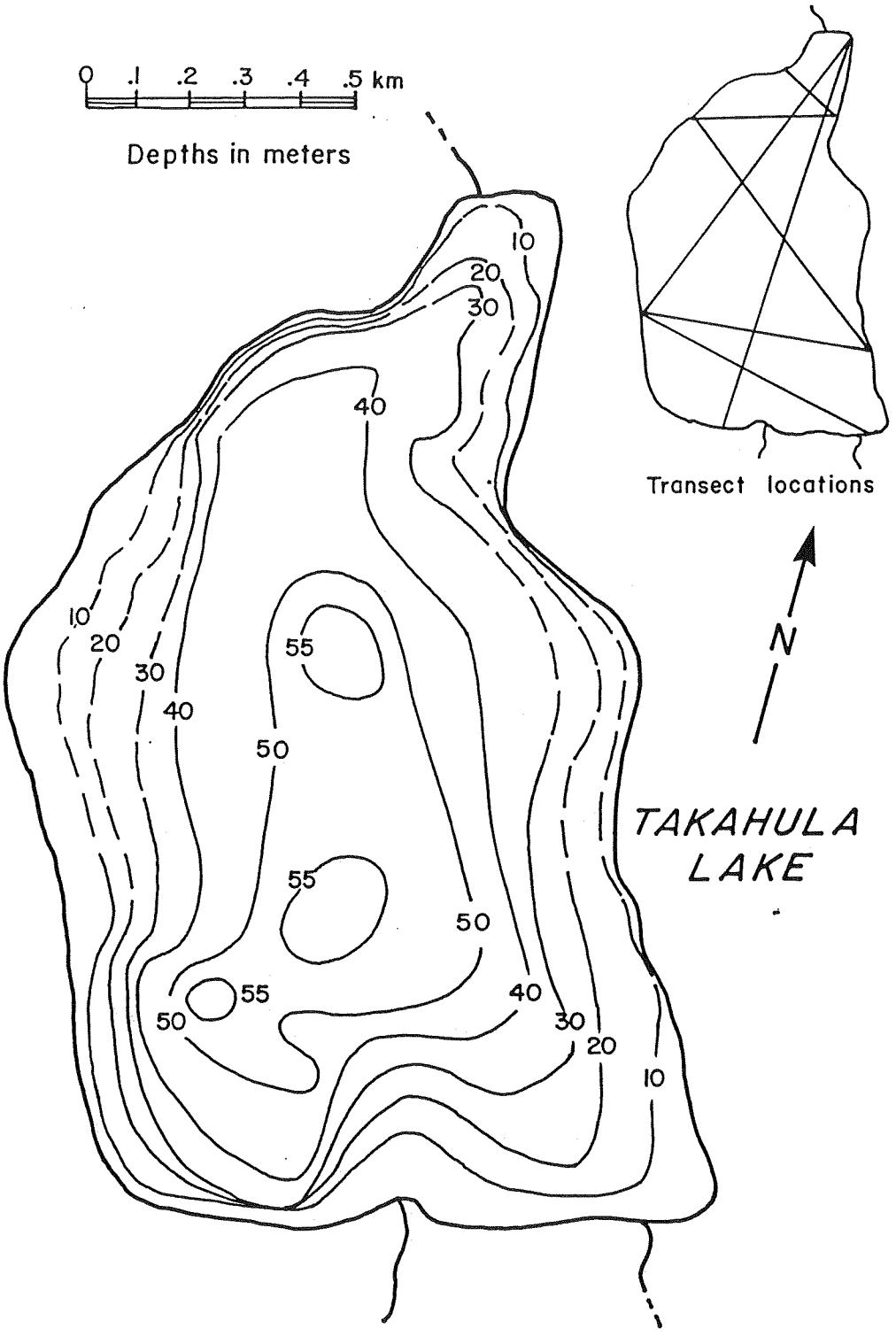
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